

Main idea for disclosure Po

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## Main Idea for Disclosure POU8-2000-0111

Prepared for and/or by an IBM Attorney - IBM Confidential

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### Title of disclosure (in English)

Dynamic CPU usage profiling and function call tracing

### Idea of disclosure

1. Describe your invention, stating the problem solved (if appropriate), and indicating the advantages of using the invention.

The AIX compiler flag `-pg` provides users the capability to collect an application's CPU usage and function call count information. This approach requires the users to compile a target application with the `-pg` compiler flag. With this flag enabled, a compiler will insert tracing functions into the target application. When the application runs, the tracing functions will collect the application's CPU usage and function call count information and output the information to a file in `gmon.out` format.

This approach has several drawbacks: (1) the application must be re-compiled with the `-pg` flag, which can be problematic if the source code is no longer available. (2) this approach is static, meaning the decision of tracing must be made before the application is scheduled to run. (3) it is difficult to just trace part of the application, e.g., just trace 10% of the functions in a target application.

Our solution is to eliminate the re-compilation requirement. The decision to trace an application can be carried out after the application has started its execution. Our solution also provides users the flexibility to choose the tracing scope, i.e., which functions to trace, at runtime. Compared with the traditional `-pg` approach, our solution is very versatile: it does not require re-compilation, the scope of tracing can be decided and changed at runtime, and the approach can be applied to production applications.

2. How does the invention solve the problem or achieve an advantage, (a description of "the invention", including figures inline as appropriate)?

The key points of our invention are: (1) provide a `-pg` like solution, mainly CPU usage profiling and function call tracing, without any of the restrictions imposed by the traditional `-pg` approach. (2) output the gathered performance data to a file in `gmon.out` format, just like a traditional `-pg` approach would do, which will empower users to use any tools that can handle `gmon.out` format, e.g., the AIX `gprof` command, or the PE `Xprofiler`.

Our invention is intended to be built on top of IBM's DPCL product. The DPCL supports dynamic instrumentation, and it also allows users to choose which function(s) in an application to be traced, and what trace option(s) to be used, all at runtime. All the decisions can be made (and changed) after an application has started its execution. By using DPCL as our development foundation, our invention can provide the following advantages:

*Dynamic Probe class Library - Open Source*

(1) no re-compilation: with DPCL as the foundation, our solution can dynamically instrument any applications, even the optimized production applications. We do not require re-compilation, so there is no need to find and re-compile those long-lost source code files.

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(2) versatile tracing scope: our solution allows users to choose which function(s) in an application to be traced at runtime. The tracing decisions can be made after an application has started its execution. Not only can users decide the functions to be traced at runtime, they can also update the traced function list at runtime, e.g., remove a function from the trace list or add a new function to the trace list.

(3) trace options: the traditional -pg approach includes two trace options: CPU usage profiling and function call tracing. The decision of which option(s) to use must be made during re-compilation stage and it cannot be changed afterward. Our solution allows users to choose the trace options at runtime, and the choice can be changed while the application is running.

(4) gmon.out format: our solution outputs the gathered performance data to a file in gmon.out format, just like the traditional -pg approach will do. This approach allows users to take advantage of existing tools, e.g., AIX gprof command or PE Xprofiler, that can process data in gmon.out format. By adopting the gmon.out format, there is no need to invent a new tool to process the performance data generated by our invention.

3. If the same advantage or problem has been identified by others (inside/outside IBM), how have those others solved it and does your solution differ and why is it better?

The DPCL provides the capability for dynamic instrumentation, and the IBM PE Benchmark Suite provides functions for MPI tracing and application profiling. But none of them provides the functions to carry out a -pg like CPU usage profiling and function call tracing, and none of them outputs performance data to a file in gmon.out format such that the data can be processed easily.

As we described in question 2, our invention provides an unique set of functions that is not available in other performance tools. The approach we propose provides users a familiar -pg like solution, yet without any of the restrictions associated with traditional -pg approach. The adoption of gmon.out format also allows users to take advantage of existing tools, which should further enhance users' acceptance of our invention.

4. If the invention is implemented in a product or prototype, include technical details, purpose, disclosure details to others and the date of that implementation.  
No

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